Optimization of Business Location

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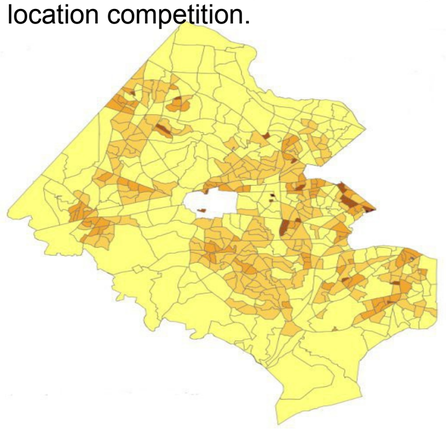
Abstract

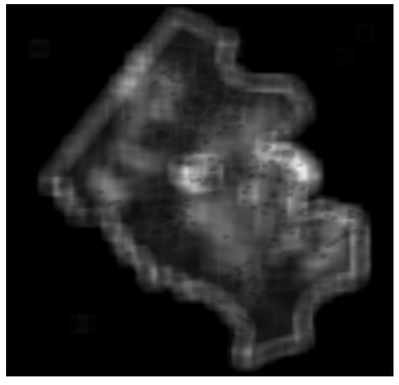
Companies often face problems when seeking the optimal location for the access to the greatest amount of consumers. The general concept of this optimization effort by businesses is called the marketing mix. The purpose of this project is to find the optimal location (the last part of the distribution channel) based simply on a few variables such as population density and location of competition. The project will feature a GUI aspect created in Java to display the optimal location of a business. The optimal location will be found using a heuristic to evaluate possible locations.

Introduction

One of the aspects of the marketing mix is the placement or location aspect (also known as the distribution channel). This aspect includes the physical location of the store as the final stage. The program aims to focus on the physical location of a possible business to maximize profit and market share. A heuristic will be written to process variables such as population density and location of location competition.



Population density map of Fairfax County



Output image

Background

The research can be classified as a location problem. Location theory was first introduced in 1909 by Alfred Weber, when he tried solving a problem to minimize the cost of labor and transportation when finding the location of a business. This program uses this approach to business locations based on quantifiable inputs. It incorporates the location of competition along with population density to determine the optimal location of a business..
Finding the optimal location is currently done through professional advisors. The advisors take into account many variables of marketing mix and distribution channel such as location of the store, advertising, price, etc. Many programs have been written to model the process, although few have succeeded because of the many variables involved. Models tend to focus on the placement aspect of the marketing mix as it is the aspect that can be more easily measured quantitatively. The variables included in the placement aspect include population density, ease of access, and location of competition. A heuristic is then developed to evaluate the data and to find the optimal location, with the objective of maximizing market share and profitability.

Developments

The optimization search is in Java with the occasional use of Python to process certain inputs. For example, Python is used to copy the data from a population density map into a usable text file and to copy all the data from a Google Maps with marked gas stations into a usable text file. The program currently includes a GUI and a heuristic class to allow for easier editing. The GUI displays a map of Fairfax County (test region) and display the suitability of the location (shown below).

Discussion of Results

The program can read in the text file with the population density and the location of local businesses, which in this case are gas stations and it includes these two inputs in a heuristic based on clusters of dense population and the distance to the closest gas station. The cluster value is calculated based on the population density of each point and each of its neighboring points. The distance of the nearest gas stations is used as a scalar. Currently, the project reflects that most gas stations indeed match up with the brighter colored locations.

Distance from closest gas station

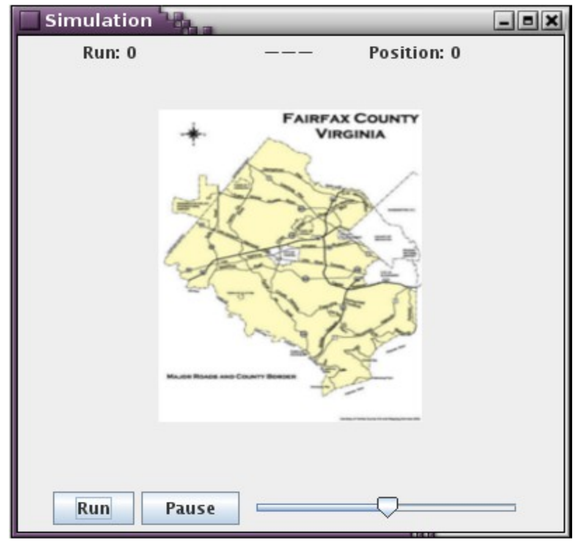
3	3	3	3
2	2	2	2
1	1	1	2
1	0	1	2

Population cluster value

984	795	832	483
675	834	923	598
412	435	683	234
538	436	534	891

Overall heuristic (population cluster x distance)

2952	2385	2496	1449
1350	1668	1846	1196
412	435	683	468
538	0	534	1782



Current GUI